Improving waste treatment and minimisation with electrokinetic geosynthetic technology

Reducing the water content of sewage sludge, mine tailings and other wastes radically simplifies management and disposal. Known as 'dewatering', the limitations of conventional systems make it difficult to undertake economically, and the development of a new, more efficient process represents a worldwide commercial opportunity. Electrokinetic Ltd is currently leading a three-year project to research the effectiveness of electrokinetic geosynthetic technology in waste treatment and minimisation.

Key benefits

- Radically improved dewatering performance for easier and significantly more efficient waste disposal
- Electrokinetic processes can make previously prohibitive waste treatment economically attractive
- Potential annual value of £555 million to the UK economy

First developed in the 1970s for use in the construction industry, geosynthetic materials are used to control the movement of water through filtration, separation, containment, reinforcement and drainage. These are 'passive' materials, with a range of functions including acting as barriers or conduits that stop or provide a passage for water movement, but do not cause it to flow.

Research started at the University of Newcastle in the 1990s and continued by Electrokinetic Ltd, however, has added a critical new dimension to the technology. By developing the concept of electrically conductive geosynthetics (EKGs), it has also enabled active physical or chemical changes to be initiated in the sludge materials or soil where they are installed. The creation of electrodes made out of polymer-based geosynthetic materials has also overcome difficulties previously caused by corrosion when they were placed in soil or sludge. Electrokinetic is now leading a three-year £1.49 million project, part-funded by the DTI under the Technology Programme, to explore innovative methods allowed by the technology of reducing the volume of waste materials whose treatment is often economically prohibitive, including agricultural, mineral, industrial and sewage.

Electrokinetic Ltd is leading the project, in partnership with the University of Newcastle, Rio Tinto, Severn Trent Water, Yorkshire Water, Corrpro Companies Europe, GKD (UK) Ltd, Edmond Nuttall Ltd, Ashbrook Simon-Hartley and CA Blackwell Ltd.

Objective

The project is a wide-ranging one, seeking to develop unique, robust and far-reaching treatment technologies for the waste management sector as a whole. It has been broken down into a number of working areas, of which the most advanced currently is the development of a more efficient belt filter press for dewatering low-value waste sludge.

Application of EKG technology to a standard belt filter press raised the solids content of dewatered sludge from 20% to 33% resulting in major reductions in volume and improvement in strength

This machine was originally an offshoot from the pulp and paper industry. It uses chemical conditioning, gravity drainage and compression to dry and minimise sludge, and has undergone only incremental steps in improving the efficiency of its processes over the last 30 years.

Solution

Now, the project team has introduced a fundamental technology change in the shape of an electrokinetic filter belt to improve radically the dewatering of biosolids and other materials during compression. Using EKG technology, the new process harnesses electroosmotic flow and other electrokinetic features in addition to normal hydraulic flow to increase the removal of water from the biosolids.

Results have already been impressive. In full scale field trials, while the conventional process produced a 'cake' of some 20% dry solids, operating at a voltage of just 17V the EKG solution raises this figure to 33%, and this is achieved at a very low additional power consumption of around 30kWhr per tonne of dry solids. Extrapolation of these results taken with the findings of earlier laboratory tests suggest that voltage gradients of up to 30V will produce cake in excess of 40% dry solids.

Results

According to Electrokinetic Managing Director David Huntley, "The effect of such dewatering performance can have a significant impact on the costs of disposal operations. We estimate that a typical EKG belt press operating continuously could reduce offsite disposal costs by more than £130,000 a year. This makes a very important difference to the economic viability of such processes across the world. We are expecting similar results from forthcoming trials on an EKG belt press for use in the treatment of mine tailings."

The development of the press is only one part of the overall project. Other areas include:

- in situ dewatering and stabilisation of lagooned wastes such as sewage sludge and mine tailings
- batch dewatering of heterogeneous wastes such as agricultural and ground engineering slurries
- adaptation of EKGs to improve the speed of conditioning and composting processes

The team estimates, in fact, that the successful commercial application of EKG technology in all the areas under research could generate a gain to the UK economy of £555 million a year.

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